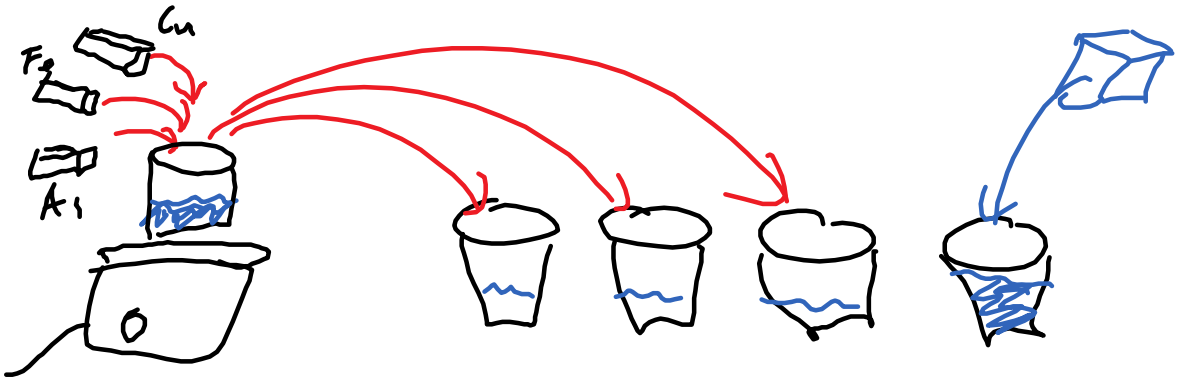
# Thermal Energy Lab (p34 lab manual)

Procedure:

Find mass of 3 metals




hotplate
beaker
3metals

4 cups with water
find mass and initial temp
add hot metals and ice -
measure final temperature

Observations:

| Substance | mass metal or ice | mass water in cup | initial temp water in cup | final temp water in cup |
|---|---|---|---|---|
| Fe | | | | |
| Al | | | | |
| Cu | | | | |
| ice | | | | |

temp of boiling water

http://physics-pages.wikispaces.com/file/view/LAB%2BMANUAL%2BPhysics%2B11.pdf/604456999/LAB%2BMANUAL%2BPhysics%2B11.pdf

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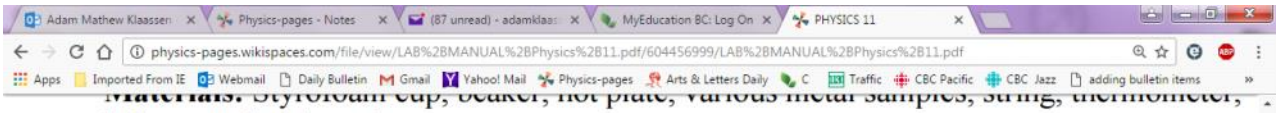



balance and an ice cube.

**Theory:** Assuming the heat gained by the water is equal to the heat lost by the metal:

$$\Delta E_{hw} = m_w c_w \Delta T_w \quad = \quad \Delta E_{hm} = m_m c_m \Delta T_m$$

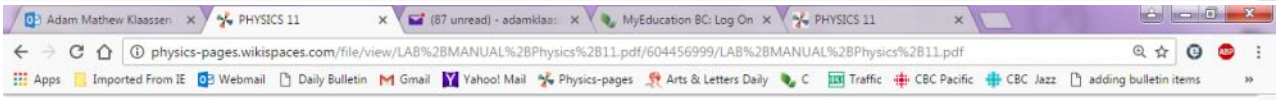
therefore: $c_m = -m_w c_w \Delta T_w / m_m \Delta T_m$

where: $\Delta E_{hw}$ = the heat energy gained by the water (J)
$m_w$ = mass of water (kg)
$c_w$ = specific heat capacity of water (J/kg °C)
$\Delta T_w$ = change in temperature of the water (°C)
$\Delta E_{hm}$ = the heat energy lost by the metal (J)
$m_m$ = mass of the metal (kg)
$c_m$ = specific heat capacity of the metal (J/kg °C)
$\Delta T_m$ = change in temperature of the metal (°C)

For ice, heat gained by ice = heat lost by water
$m_{ice}H_{ice} + m_{ice}c_w\Delta T_{ice} = - m_w c_w \Delta T_w$
solve for $H_{ice}$

**Procedure:**

1.Fill a beaker about half full of water and boil it.




For ice, heat gained by ice = heat lost by water
$m_{ice}H_{ice} + m_{ice}c_w\Delta T_{ice} = - m_w c_w \Delta T_w$
solve for $H_{ice}$

**Procedure:**

1.Fill a beaker about half full of water and boil it.
2.Record the mass of 4 Styrofoam cups individually or zero the scale with one then fill it about quarter full with tap water, the fourth should be 3 quarters full. Record the mass of the water in each.
3.Weigh each metal. Using a string or tongs, carefully lower the metals into the boiling water(metals can break the beaker). Let them stay in the water for about 5 minutes.
4.Record the initial temperature of the cold water in each cup.
5.Put the hot metal into the cold water. Cover the cup and stir. Record the highest temperature reached after the metal has been placed inside the cup. Put the ice in the fourth cup and record the lowest temperature
6.Calculate the specific heat capacity of the metal and heat of fusion of the ice.

**Questions:**

1.Compare the specific heat capacities and heat of fusion that you found to the accepted values.
2.Make sure you list the sources of error in your experiment and give evidence.